4. Use the exponent law for a power of a product.

a) $(6 \times 4)^3 = 6^3 \times 4^3$

b) $(2 \times 5)^4 = 2^4 \times 5^4$

c) $[(-2) \times 3]^5 = (-2)^5 \times 3^5$

d) $(25 \times 4)^2 = 25^2 \times 4^2$

e) $(11 \times 3)^1 = 11^1 \times 3^1$

f) $[(-3) \times (-2)]^3 = (-3)^3 \times (-2)^3$

6. Use the exponent law for a power of a power.

a) $(3^2)^4 = 3^{2 \times 4}$
$= 3^8$

b) $(6^3)^3 = 6^{3 \times 3}$
$= 6^9$

c) $(5^3)^1 = 5^{3 \times 1}$
$= 5^3$

d) $(7^0)^6 = 7^{0 \times 6}$
$= 7^0$

e) $-(8^2)^2 = -(8^{2 \times 2})$
$= -8^4$

f) $[(-3)^4]^2 = (-3)^{4 \times 2}$
$= (-3)^8$

11. The expression $[(-2)^3]^4$ is positive because its exponent is even after the power of a power law is applied:
$[(-2)^3]^4 = (-2)^{12}$
The sign of a product with an even number of negative factors is positive.

The expression $[(-2)^3]^5$ is negative because its exponent is odd after the power of a power law is applied: $[(-2)^3]^5 = (-2)^{15}$
The sign of a product with an odd number of negative factors is negative

14. Use the exponent laws to simplify first.

a) $(3^2 \times 3^1)^2 = (3^{2+1})^2$ Use the exponent law for products.
$= (3^3)^2$ Use the power of a power law.
$= 3^{3 \times 2}$ Multiply the exponents.
$= 3^6$
$= 729$

c) $[(-2)^0 \times (-2)^3]^2 = [(-2)^{0+3}]^2$ Use the exponent law for products.
$= [(-2)^3]^2$ Use the power of a power law.
$= (-2)^{3 \times 2}$ Multiply the exponents.
$= (-2)^6$
$= 64$

e) $(10^3)^2 \times (10^2)^3 = 10^{3 \times 2} \times 10^{2 \times 3}$ Use the power of a power law.
$= 10^6 \times 10^6$ Use the exponent law for products.
$= 10^{6+6}$ Add the exponents.
$= 10^{12}$
$= 1\ 000\ 000\ 000\ 000$

h) $[(-2)^2]^3 \times (-2)^3 = (-2)^{2 \times 3} \times (-2)^3$ Use the power of a power law.
$= (-2)^6 \times (-2)^3$ Use the exponent law for products.
$= (-2)^{6+3}$ Add the exponents.
$= (-2)^9$
$= -512$

19. Use the exponent laws to simplify first, where appropriate.

b) $(6 \times 8)^5 + (5^3)^2 = 48^5 + 5^{3 \times 2}$ Use the exponent law for products and the power of a power law.
$= 48^5 + 5^6$ Use a calculator.
$= 254\ 819\ 593$

c) $[(-4)^3 \times (-4)^2]^2 + (4^3 \times 4^2)^2 = [(-4)^{3+2}]^2 + (4^{3+2})^2$ Use the exponent law for products.
$= [(-4)^5]^2 + (4^5)^2$ Use the power of a power law.
$= (-4)^{5 \times 2} + 4^{5 \times 2}$ Multiply the exponents.
$= (-4)^{10} + 4^{10}$ Use a calculator.
$= 1\ 048\ 576 + 1\ 048\ 576$
$= 2\ 097\ 152$

d) $[(-2)^4]^3 + [(-4)^3]^2 - [(-3)^2]^4 = (-2)^{4 \times 3} + (-4)^{3 \times 2} - (-3)^{2 \times 4}$ Use the power of a power law.
$= (-2)^{12} + (-4)^6 - (-3)^8$ Use a calculator.
$= 4096 + 4096 - 6561$
$= 1631$

e) $[(-3)^4]^2 \times [(-4)^0]^2 - [(-3)^3]^0 = (-3)^{4 \times 2} \times (-4)^{0 \times 2} - (-3)^{3 \times 0}$ Use the power of a power law.
$= (-3)^8 \times (4)^0 - (3)^0$ Use a calculator and the zero exponent law.
$= 6561 \times 1 - 1$
$= 6560$